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exclusively medical institution, and as this work is printed and published at his own expense, and not as a part of any public reports or proceedings. Professor T. A. Smith's book on *Salmonides* and *Coregonides*, just issued, may perhaps likewise not yet have been received here.

Before leaving our Swedish zoologists I wish to mention the work that some of them are engaged in at present. Their Nestor, Professor S. Lovén, now seventy-seven years of age, is revising the *Echinoderms* described by Linnæus. Professor Lilljeborg is publishing his book on the *Scandinavian Fishes*, and, after having finished that work, he intends to publish a volume on the *Entomestraca*. Théel is working on the *Holothurians* collected on board the United States steamer "Blake." C. Bovallius is busy with the *Hyperidæ* and the parasitic *Isopods*, C. Aurivillius with the *Lepadidæ*, F. Fristedt with the *Sponges* contained in our "Riksmuseum."

FIDDLER-CRABS.

BY J. M'NAIR WRIGHT.

MY most intimate friends at the seaside are the ill-tempered but handsome fiddler-crabs,—*Gelasimus* of science. I enjoy their beauty and their ability, but am no doubt cordially hated by them for my interference with their domestic affairs. There is an intensity to their action which is seldom met with among the lower inhabitants of the shore. I have watched them by the hour and have never tired. Their holes dot the beach in favored localities, and near each hole is a small heap of sand brought up from below by the industrious digger, whose cellar never seems large enough. I have noticed that there is a correspondence between the noise made in seating one's self near a hole and the length of time that elapses before the worker appears, and that his first appearance is made with extreme caution. There can be no question about his sense of hearing. A rap near the hole keeps him down a long time, conversation in the vicinity has the same effect, and then when he does venture to appear at his door, it is with the most timid air. He protrudes but a portion of his body and then carefully examines his sur-

roundings. A sharp, shrill whistle when he is out causes him to dart in like a flash, but repeat it several times and he gains courage and now exhibits his curiosity. His whole body becomes attention. He erects himself and elevates his stalked eyes,—a better picture of listening it would be difficult to find.

It is the male fiddler that does the house-building. When undisturbed he remains below from half a minute to two minutes, and then reappears with his large claw folded close against the body and on it an armful of sand. Reaching the door, he gives the arm a quick flit and throws the sand with considerable accuracy upon the heap. After discharging the load, the pert eyes are erected and Gelasimus looks about. If an animal's actions express anything, he certainly listens at the same time, and, in my opinion, his interest centres in the stage of the tide. I have never seen a mention of this watchfulness, but hundreds of observations have convinced me that the fiddler does keep watch of the tide. When the tide is well out he exhibits less concern, but makes his trips in and out of his hole as rapidly as possible; but as the tide comes in his actions change: the watchfulness and the appearance of listening are more marked. When but a few minutes—it may be a quarter of an hour—remain before the incoming tide will cover his home, he stops digging and makes excursions for food, which he carries to his larder below. As the tide advances these excursions are shorter. He looks before each run, and seldom fails to bring in some toothsome morsel. In this connection I have noticed three points: he is never caught by a wave as it rolls up the beach, he never comes out after a wave rolls over his dwelling, and he never stays in his burrow a wave too soon. He does not close his door with his big claw, as sometimes said. He knows too well that this is not necessary, for the first wave that rolls over his home will fill up the hole with that very sand that he has so laboriously excavated.

When the tide is well out the fiddler does not stop digging to collect food. His plan is to first build his house and then stock it with provisions. He will not, however, refuse to take any food which comes in his way, even when most busily engaged in his excavations. When the proper time comes he finds his food in the line of foam and sea-weed left by the successive waves as they come up the beach. Here he finds a fine bill of fare,—flies, mos-

quitoes, and the like, which are caught and left half drowned by the incoming wave. I once saw a fiddler running back to his hole and bearing a round red ball which looked like a drop of blood and which offered a brilliant contrast with his own pale tan color. I caught him at his door and took from him a living "lady-bird." Released, the crab quickly disappeared below, and there he remained a long time, evidently afraid to come out. But the need of provision and the advancing tide at length drove him out. Coming up, he found his lady-bird lying just at his door; he snatched it eagerly and scuttled backwards down the burrow to put it with his other goodies.

The muscular strength of these crabs is considerable. There is an enormous element of error in contrasting the work of any small animal with that of the "lords of creation," but it is fascinating. Imagine a man in digging to take a load of earth or sand at each shovelful which equals one-fourth his own size and weight, throw it from six to twelve feet, and continue this between two tides until he had a pile from eight to fourteen feet in height. What a Hercules he would be! I have often tried the strength of the fiddler in another way. When he is below I have laid a bit of stick or shell lightly over his hole. If this be very light, his upward rush removes it and he does not appear to have the slightest curiosity or alarm; nor is he delayed below by the darkening of his hole,—a curious fact when one considers his powers of sight. If the shell be a little larger, his first rush does not remove it, although it shakes with the shock. He retires, and is apparently alarmed, for an interval elapses before he comes up again, this time with more force. I have seen a crab thus dislodge a pebble twice the size of his body and much more than his entire weight, causing it to fly into the air two or three inches. He does not remove the obstacle with his big claw, for he immediately comes out with that loaded with sand as before. He charges against it and knocks it away with a blow like a miniature battering-ram. This covering the hole, if silently done, does not seem to alarm the crab or excite its suspicion.

The fiddler, unlike most of his relatives, is a family crab. His wife cannot dig or clean out the dwelling, for she lacks the large claw which is such a useful member in the male. She is not a gad-about. She is content to stay below, and is far less frequently seen than are the males.

The males are very pugnacious, rivalling the oft-described hermit-crabs in this respect. When two meet they almost invariably threaten each other, if they do not at once fall to blows. If the tide is almost up to their homes they seem to agree to postpone the battle, but at other times they quickly begin the fray. When the foe is in sight the crab, whose body has been close to the sand, its legs spread out, its big claw folded close against the body, at once puts its forces on a war-footing. The slender legs are drawn in, and, walking on the tips of his toes, he elevates his body high in the air and puts his large claw, at once an organ of offence and defence, at an angle of forty-five degrees. His eyes are elevated, so as to obtain a clear view, and then he flings himself towards his opponent. As he does so he draws down his eyes for safety and still further extends his big claw, with which he tries to grasp his antagonist, who, in the mean time, has been going through similar preparations. The loss of a limb is not such a serious affair to them as it is to larger warriors. The wound caused by the amputation soon scars over, and when the next molt takes place a new limb appears just like its predecessor, only smaller. At a subsequent molt it gains its proper size.

The fiddler has no feature more curious than his power of packing or doubling himself up. The door to his underground home looks scarcely larger than his square compact body, and yet, when alarmed, he goes into it like a flash. He runs to the opening and then folds down those curiously mobile eyes, packs away his eight walking-legs and his big and little claws, and disappears below. Unless you have actually watched him, you can hardly believe that the fiddler which you saw a moment before hurrying across the beach and waving his hands with those gestures which have given him his name has darted into that small opening. You are more inclined to think that, like the people in the fairy tales, he has donned his cap of invisibility and that this explains the mystery.